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GROUP 23

CONTINUOUSLY VARIABLE TRANSMISSION (CVT)

CONTENTS

CVT

GENERAL INFORMATION

M2231000100165

The F1C1A transmission is adopted for the CVT. This transmission is basically the same as conventional transmission.
The ATF warmer (ATF cooler) is adopted.

SPECIFICATIONS

Item		Specification
Transmission model		F1C1A
Engine model		4A91
Torque converter	Type	3-element, 1-stage, 2-phase type
	Lock-up	Provided
	Stall torque ratio	2.0
Transmission type		Forward automatic continuously variable (steel belt type), 1st in reverse
Gear ratio	Forward	2.319 – 0.445
	Reverse	2.588
Clutch		A pair of multi-plate system
Brake		A pair of multi-plate system
Manual control system		P-R-N-D-Ds-L (smart shift)
Function	Variable speed control	Yes
	Line pressure control	Yes
	Direct engagement control	Yes
	N-D/N-R control	Yes
	Shift pattern control	Yes
	Self-diagnosis	Yes
	Failsafe	Yes
Oil pump	Type	External gear pump
	Configuration	Built-in (chain drive)
Control method		Electronic control (INVECS-III)
Transmission oil	Specified lubricants	DIA QUEEN ATF SP III
	Quantity L	8.1

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ELECTRONIC CONTROL SYSTEM

EEPROM

M2231012000024

Because EEPROM has been used, even if the battery terminals or control unit connectors are disconnected, the necessary learned values are stored in the engine-CVT-ECU to prevent a loss of shift quality. (Initialisation is available by M.U.T.-III).

CONTROLLER AREA NETWORK (CAN) COMMUNICATION

M2231017000018

CAN* communication has been adopted for communication with other ECUs in order to decrease the number of wires and ensure information transmission. For CVT control, the engine-CVT-ECU receives the following signals.

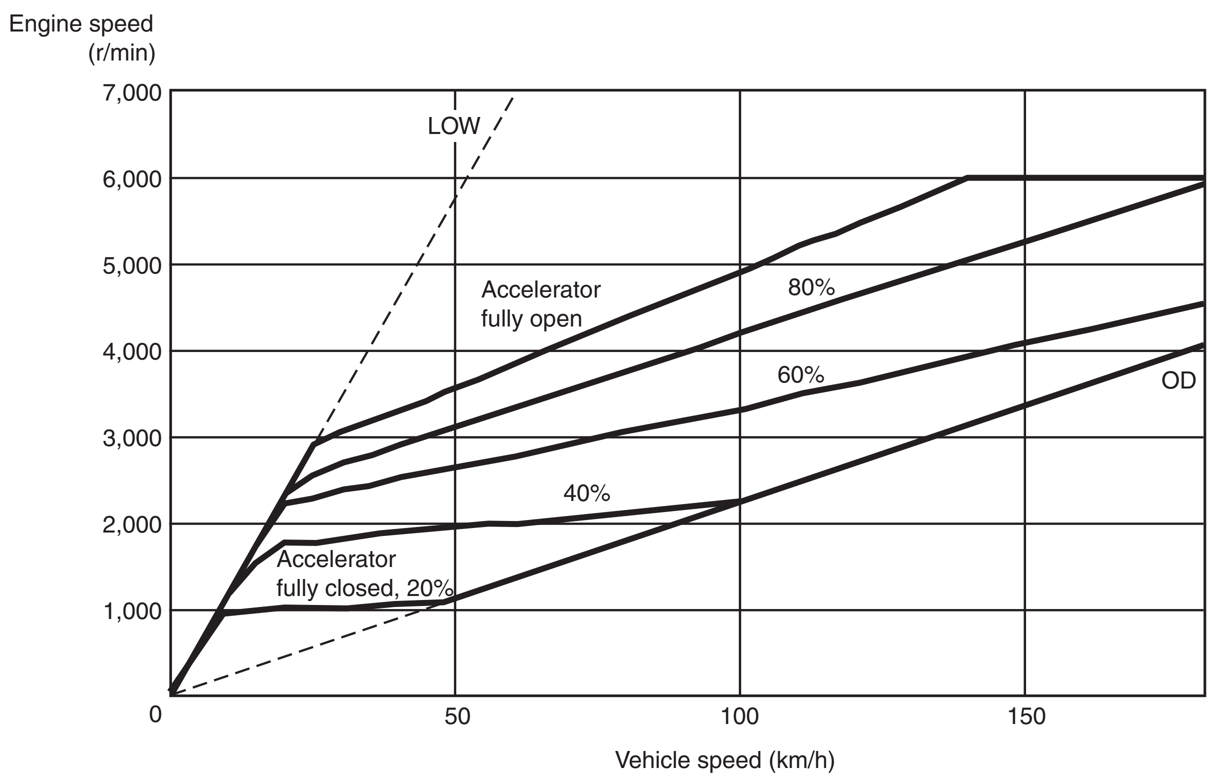
CAN COMMUNICATION INPUT SIGNAL TABLE

Input signal	Transmitter ECU
Average vehicle speed signal from drive wheels	ABS-ECU
Motor current signal	EPS-ECU
EPS warning lamp illumination request signal	
Compressor signal	Meter and A/C-ECU

*NOTE: *: For more information about CAN (Controller Area Network), refer to GROUP 54C* *P.54C-2.*

RATIO PATTERN

M2231013000061



AC403740AE

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DIAGNOSIS CLASSIFICATION TABLE

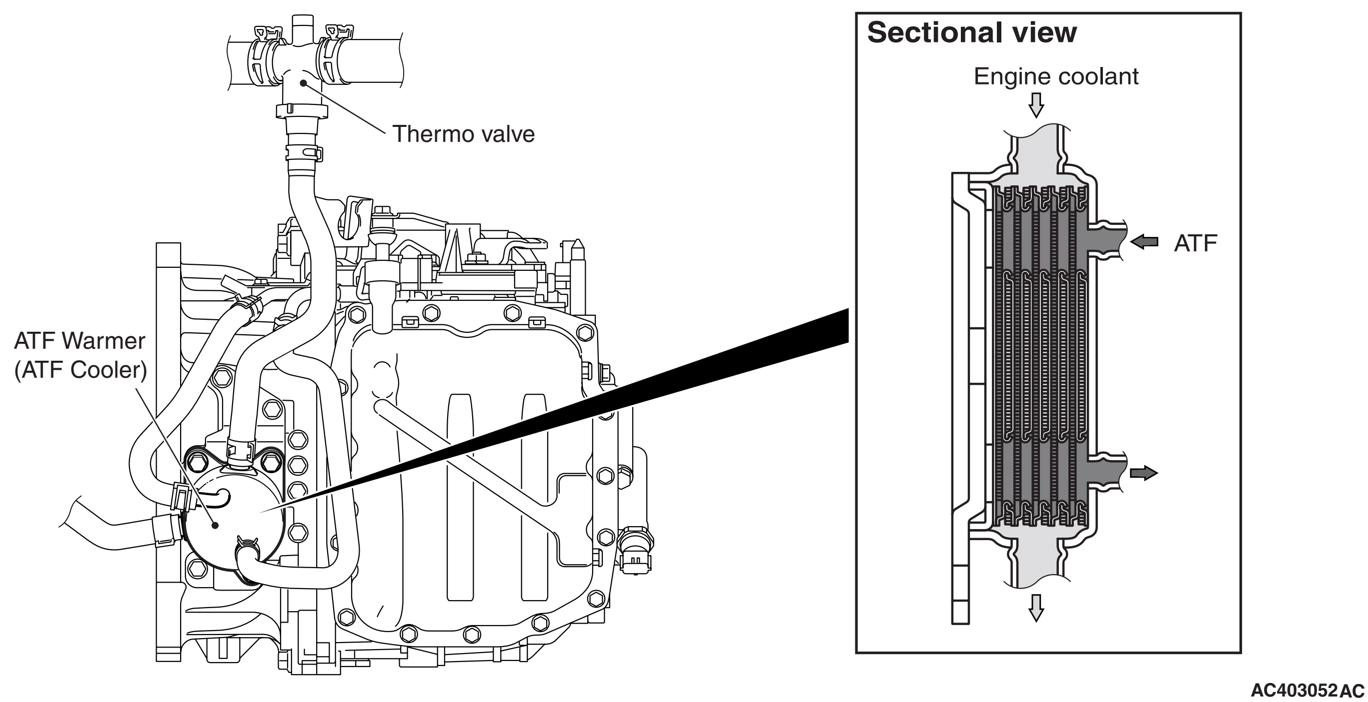
M2231015000056

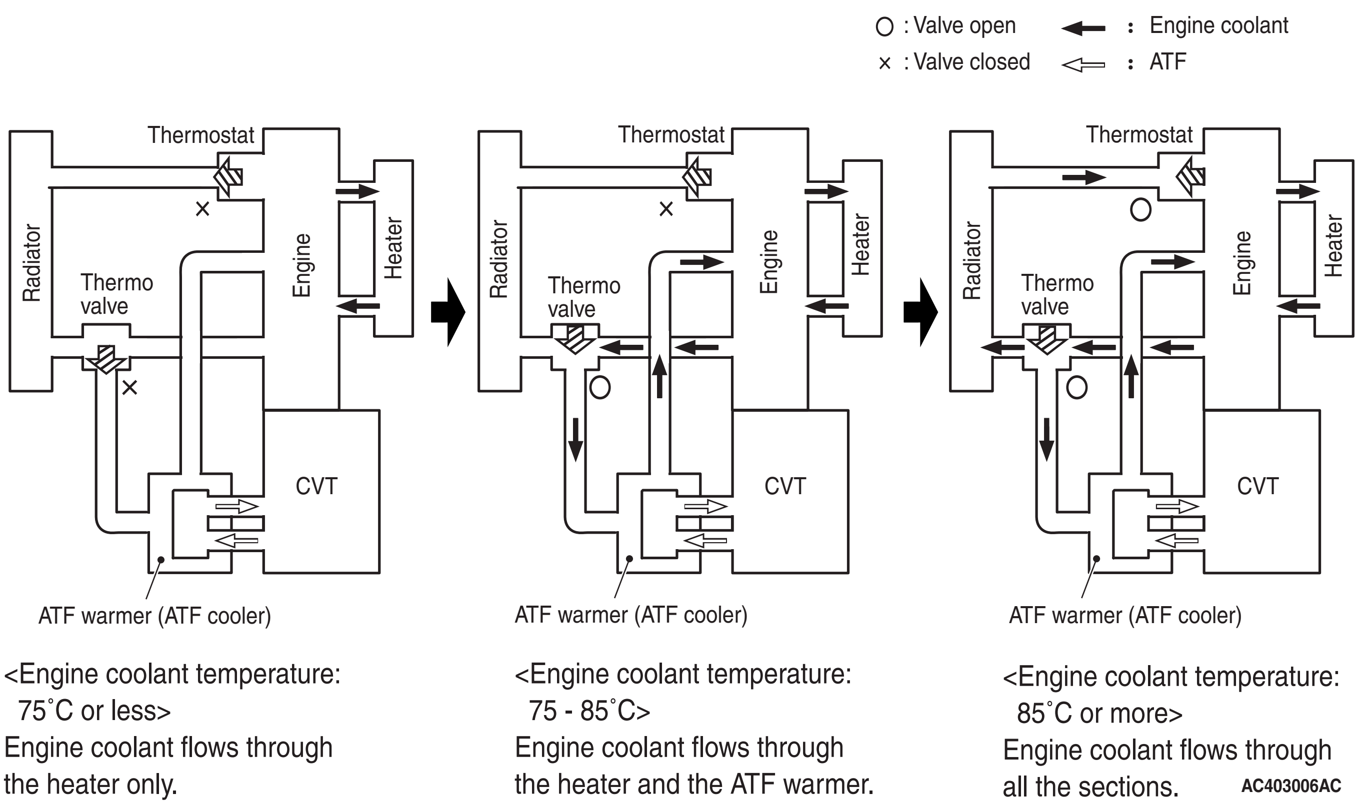
Item	Diagnosis		Data list		Actuator test
	Code No.	Trouble symptoms	Item No.	Display	
Crank angle sensor	–	–	01	r/min	–
CVT fluid temperature sensor	15	Open circuit	08	°C	–
	16	Short circuit			
Line pressure sensor	18	Open circuit	09	MPa	–
	19	Short circuit			
Turbine speed sensor	22	Open circuit	02	r/min	–
Primary speed sensor	23	Open circuit	03	r/min	–
	26	System failure			
Secondary speed sensor	24	Open circuit	04	r/min	–
	25	System failure			
Accelerator pedal position sensor (APS)	–	–	06	mV	–
Primary pressure sensor	27	Open circuit	11	MPa	–
	28	Short circuit			
Gear ratio	–	–	12	Displays the gear ratio.	–
Line pressure control solenoid valve	31	Open circuit/short circuit	16	%	01
Shift control solenoid valve	32	Open circuit	15	%	02
	36	Short circuit			
Damper clutch control solenoid valve	33	Open circuit	14	%	03
	37	Short circuit			
Clutch pressure control solenoid valve	34	Open circuit	17	%	04
	38	Short circuit			
Shift system	42	System failure	–	–	–
Damper clutch system	44	System failure	10	r/min	–
	45				
Clutch system	46	System failure	–	–	–
	48				
Inhibitor switch	51	Open circuit	26	P/R/N/D/Ds/L	–
	52	Short circuit			
Stop lamp switch	53	Open circuit	33	ON/OFF	–
	54	Short circuit			
Battery voltage	–	–	24	V	–
CVT control relay	56	Open circuit	25	V	11
Steel belt system	59	System failure	–	–	–
Line pressure system	57	System failure	–	–	–
	71				
	72				

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ATF WARMER (ATF COOLER)

M2230000600082





The ATF warmer (ATF cooler) is adopted. (the ATF cooler incorporating the radiator is not adopted)

At the start of running, the temperature of the engine coolant rises earlier than that of the ATF. The ATF warmer utilizes this characteristic to raise the ATF temperature as early as possible to an appropriate level (70 - 80 °C). It also controls fluid temperature stably and reduces ATF agitation resistance to improve fuel consumption ratio.

In addition, a thermo-valve has been adopted to restrict the engine coolant supply to the ATF warmer (ATF cooler) until the engine coolant temperature reaches the appropriate temperature when low temperature start in winter, giving the priority to the heating performance.

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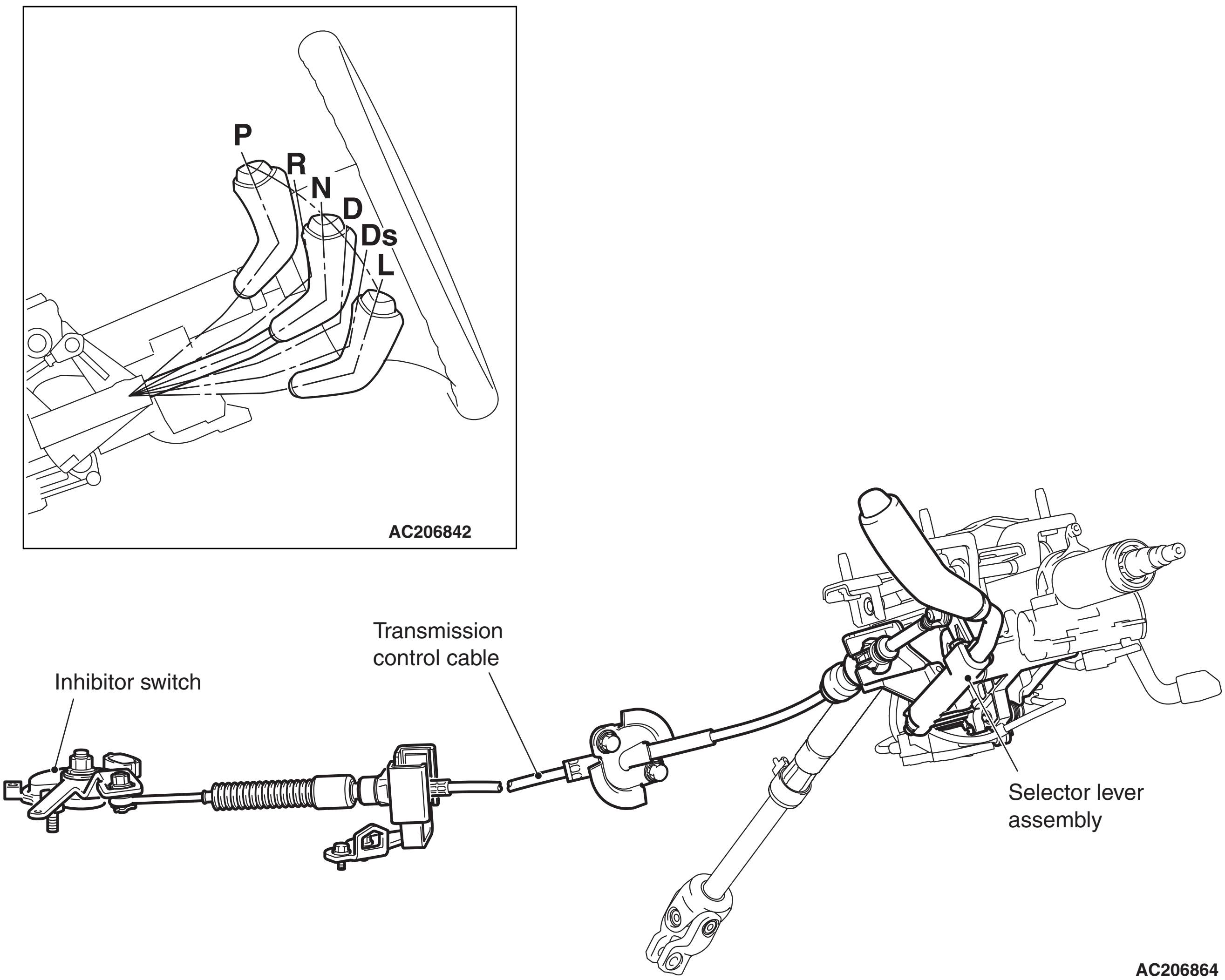
TRANSMISSION CONTROL

GENERAL INFORMATION

M2232000100447

- A smart shift type selector lever has been adopted in order to facilitate walkthrough between the seats.
- A gun grip type selector lever knob has been adopted for better operation and easier visual recognition of the switches arranged in the centre panel.
- The selector lever assembly has been a single unit made by aluminium die casting for better accuracy and fewer parts, resulting in the light-weight and compact structure.
- The selector lever has been designed to be compact and appropriately configured not to interfere with the energy absorbing mechanism on the steering column upon impact of the vehicle.
- In order to prevent abrupt start by erroneous operation of selector lever, a CVT erroneous operation prevention mechanism (the shiftlock mechanism and key interlock mechanism) has been adopted.

COMPONENT VIEW

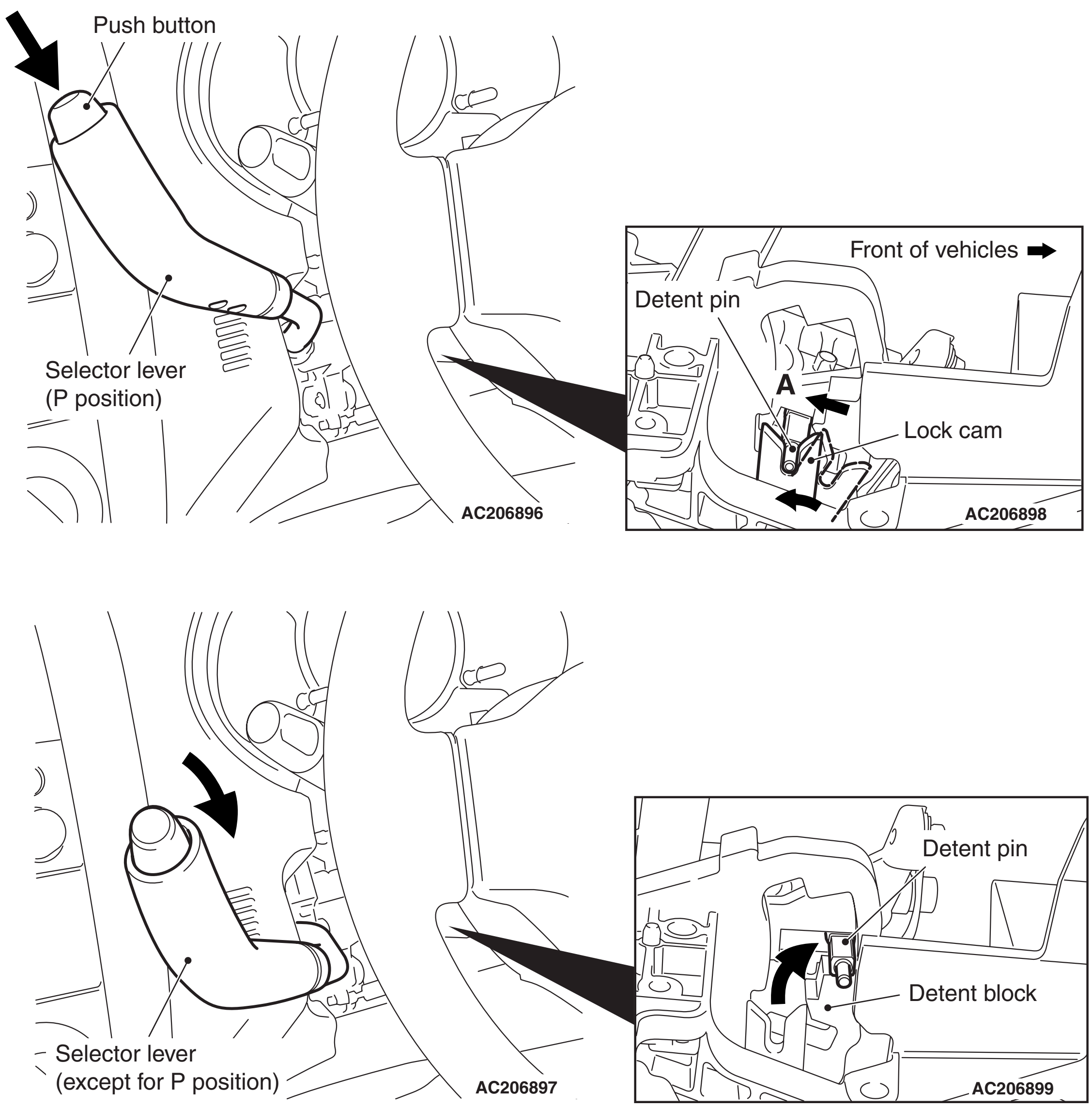


AC206864
AC207638AB

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SELECTOR LEVER ASSEMBLY

M2232002000190



AC207644AB

Operation

1. When the selector lever is in the P position, the detent pin is engaged with the lock cam. When the pushbutton on the selector lever is pressed, the detent pin moves in the direction A as illustrated in the figure to rotate the lock cam.
2. When the detent pin rotates the lock cam to disengage, the selector lever can go over the protruding part of the detent block. This enables shifting the selector lever.

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CVT ERRONEOUS OPERATION PREVENTION MECHANISMS

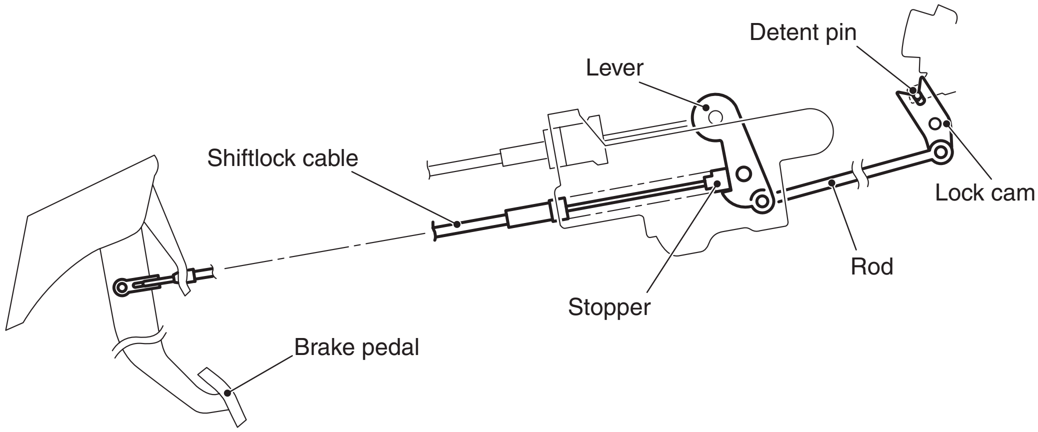
M2232003000104

SHIFT LOCK MECHANISM

Only when the following two conditions are satisfied, the selector lever can be shifted from the P position to another position:

- When the brake pedal is depressed
- When the ignition key is in other than the LOCK (OFF) position

When the brake pedal is not depressed

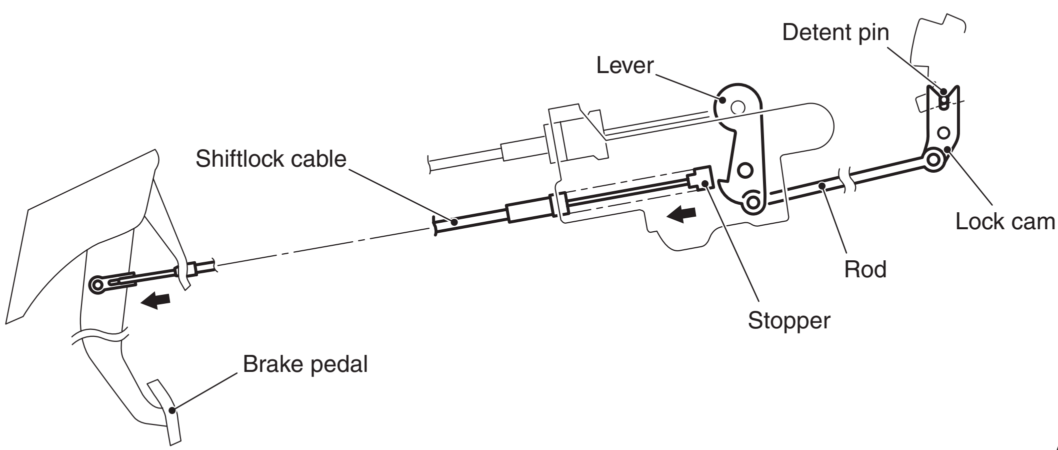


AC206902AB

When the selector lever is in the P position with the brake pedal not depressed, the shiftlock cable stopper keeps the lever locked so that the rod and lock cam do not move.

As a result of this, the pushbutton of the selector lever linked to the detent pin cannot be pressed and the selector lever cannot be shifted from the P position to another position.

When the brake pedal is depressed



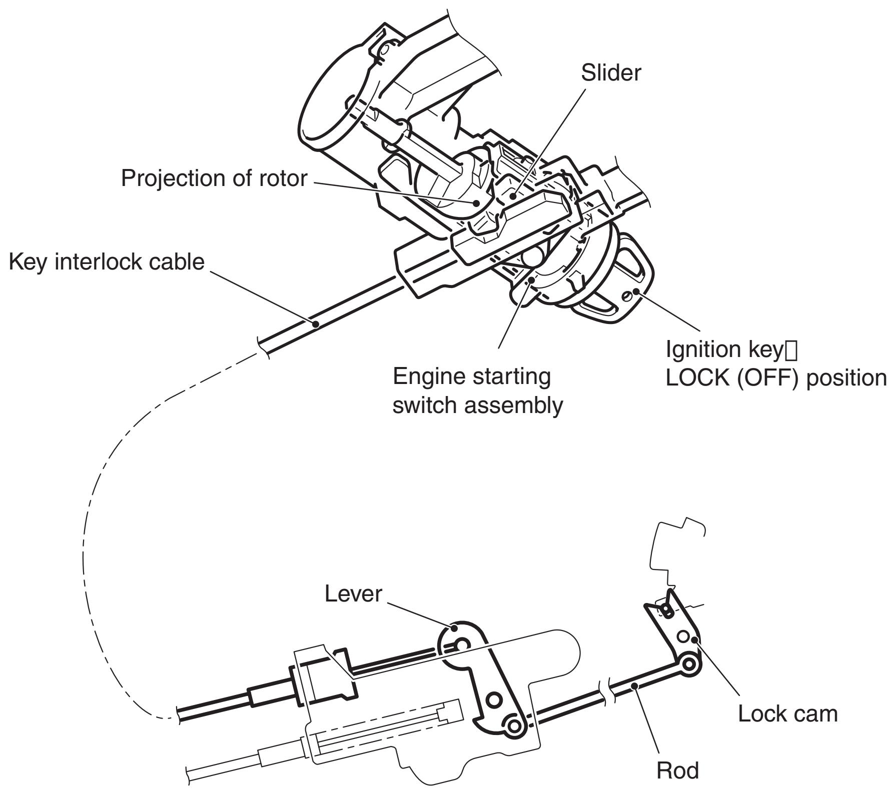
AC206903AB

When the brake pedal is depressed, the stopper is pulled by the shiftlock cable so that the lever becomes unlocked.
Then the lock cam linked to the rod can also rotate so that the selector lever can be shifted from the P position to another position by pressing the pushbutton.

NOTE: When the brake pedal is depressed with the ignition key in the LOCK (OFF) position, the selector lever cannot be shifted from the P position to another position.

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When the ignition key is in the LOCK (OFF) position or pulled out (With the selector lever in the P position)



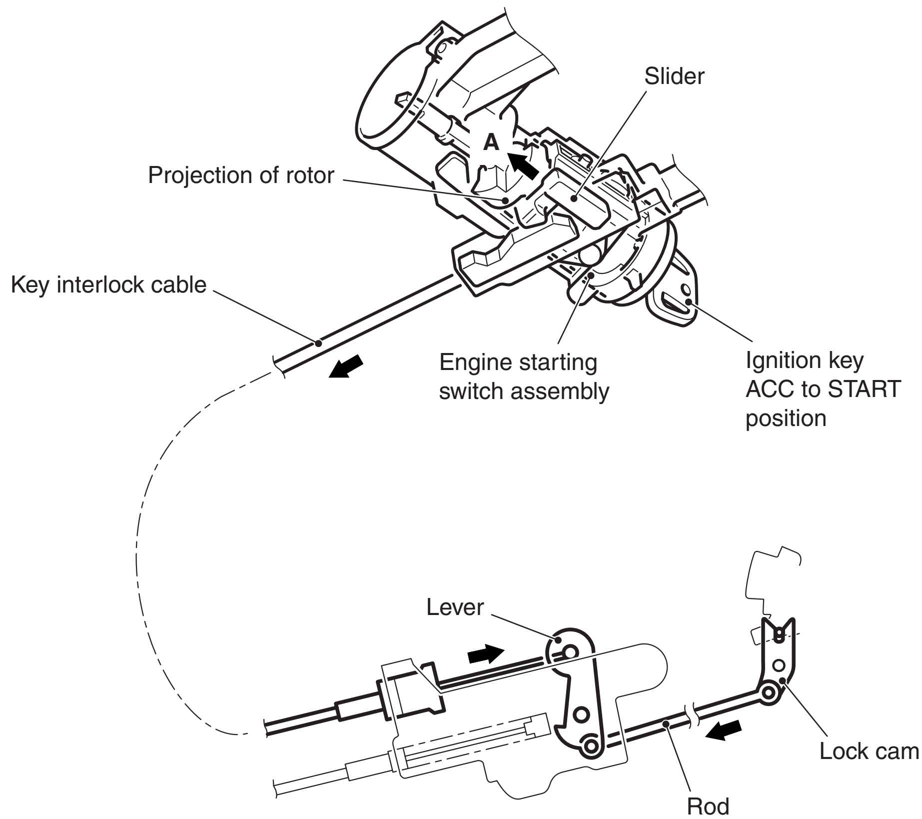
AC206911AB

In the engine starting switch assembly, the slider is engaged with the groove of the key interlock cable, and the slider is locked by the projection of the rotor so that the key interlock cable as well as the lever, rod, and lock cam does not move.

As a result of this, any attempt to shift the selector lever is prevented. The pushbutton on the selector lever cannot be pressed because the lock cam does not rotate, then the selector lever cannot be shifted from the P position to another position.

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When the ignition key is in other than the LOCK (OFF) position (With the selector lever in the P position)



The rotor in the engine starting switch assembly has a notch between ACC and START so that the slider becomes unlocked.

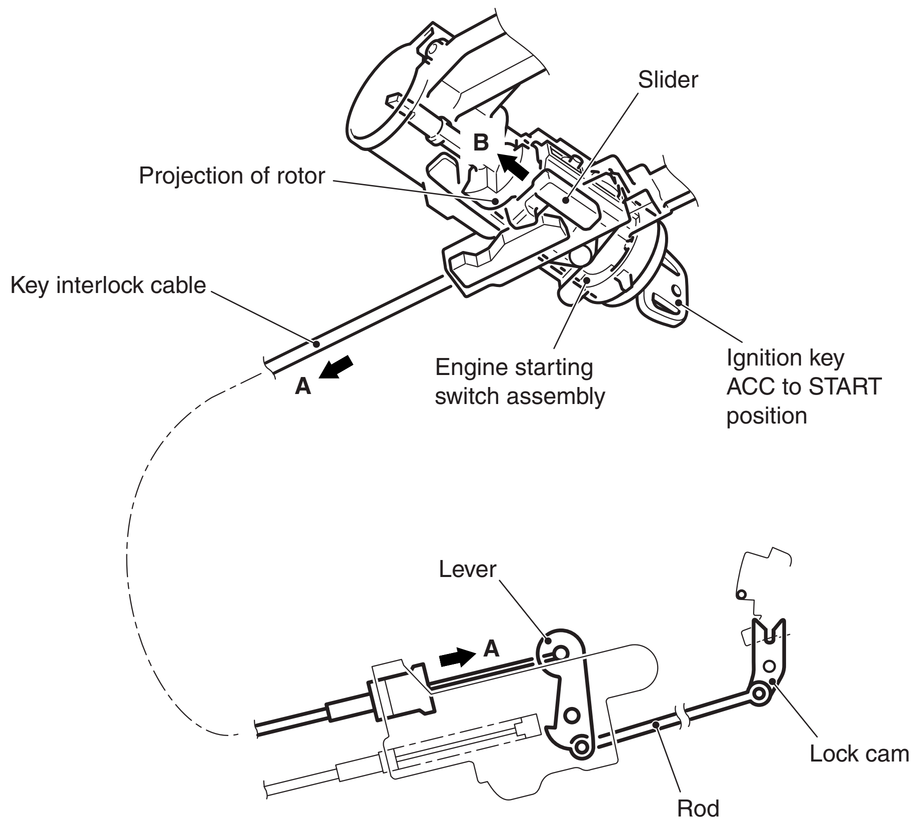
Then the slider can move in the direction A as illustrated in the figure to allow the lock cam to rotate so that the selector lever can be shifted from the P position to another position by pressing the pushbutton.

NOTE: When the ignition key is in other than the LOCK (OFF) position with the brake pedal not depressed, the selector lever cannot be shifted from the P position to another position.

KEY INTERLOCK MECHANISM

When the selector lever is not in the P position, the ignition key cannot be turned to the LOCK (OFF) position and pulled out.

When pulling out the key with the selector lever in other than the P position

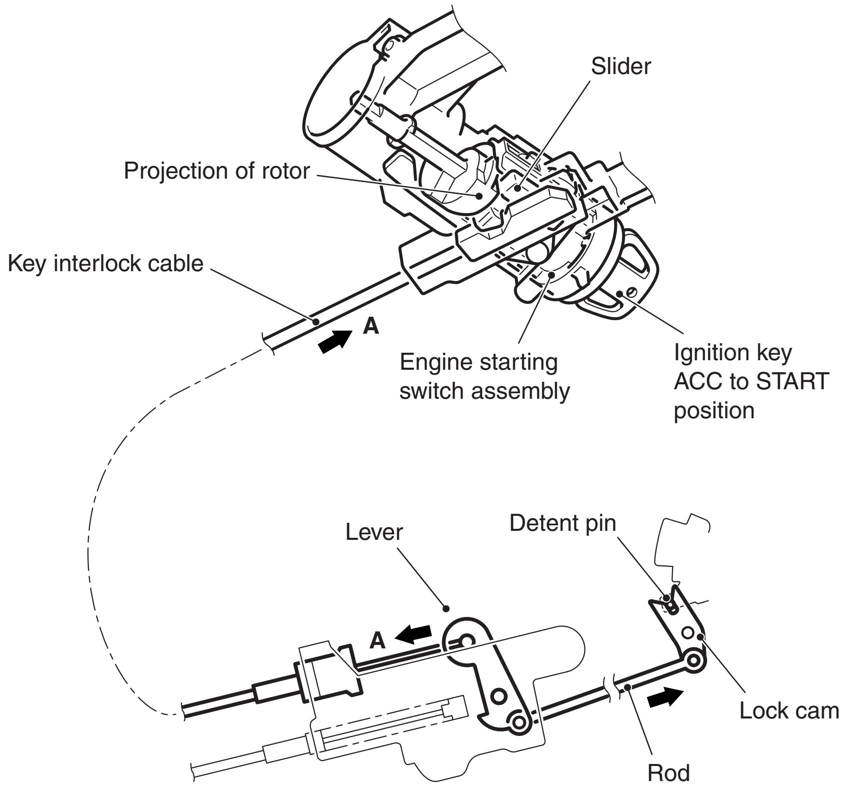


The lock cam is kept in a rotated condition, and the key interlock cable is kept pulled in direction A as illustrated in the figure. In this state, the slider in the engine starting switch assembly is moved and locked in direction B as illustrated in the figure.

As a result of this, any attempt to turn the ignition key to the LOCK (OFF) position is prevented because the slider prevents the rotor from rotating, and the ignition key can only turn up to the ACC position and cannot be pulled out.

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When pulling out the key with the selector lever in the P position



AC206911AC

When releasing the pushbutton on the selector lever with the selector lever in the P position, the lock cam is rotated by the detent pin. Then the key interlock cable is moved by the lock cam in direction A as illustrated in the figure.

As a result of this, the slider in the engine starting switch assembly is unlocked. The rotor can then turn, and the ignition key can be pulled out by turning it to the LOCK (OFF) position.